PYGMY RABBIT POPULATION MONITORING

PINEDALE ANTICLINE PROJECT AREA

and

BOULDER REFERENCE AREA, 2011

Hayden-Wing Associates, LLC
Natural Resource Consultants

Monitoring Requirements

- Wildlife Monitoring and Mitigation Matrix, 2008 ROD:

- "3 consecutive years of decline in presence or absence of a species,

                                  or

an average of 15% decline in numbers of individuals each year over 3 years"

Site-Occupancy Analysis
(MacKenzie et al 2006)

- "Most powerful tool available for monitoring presence/absence"
(UW Coop Fish and Wildlife review)

- Occupancy will be correlated with population size

- Accounts for effect of detection probability

- Generates unbiased estimates of occupancy

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Monitoring Objectives:

- Determine pygmy rabbit occupancy

- Determine presence or absence of pygmy rabbits in PAPA and Reference sites

- Visit each site 2 x to calculate detection probabilities
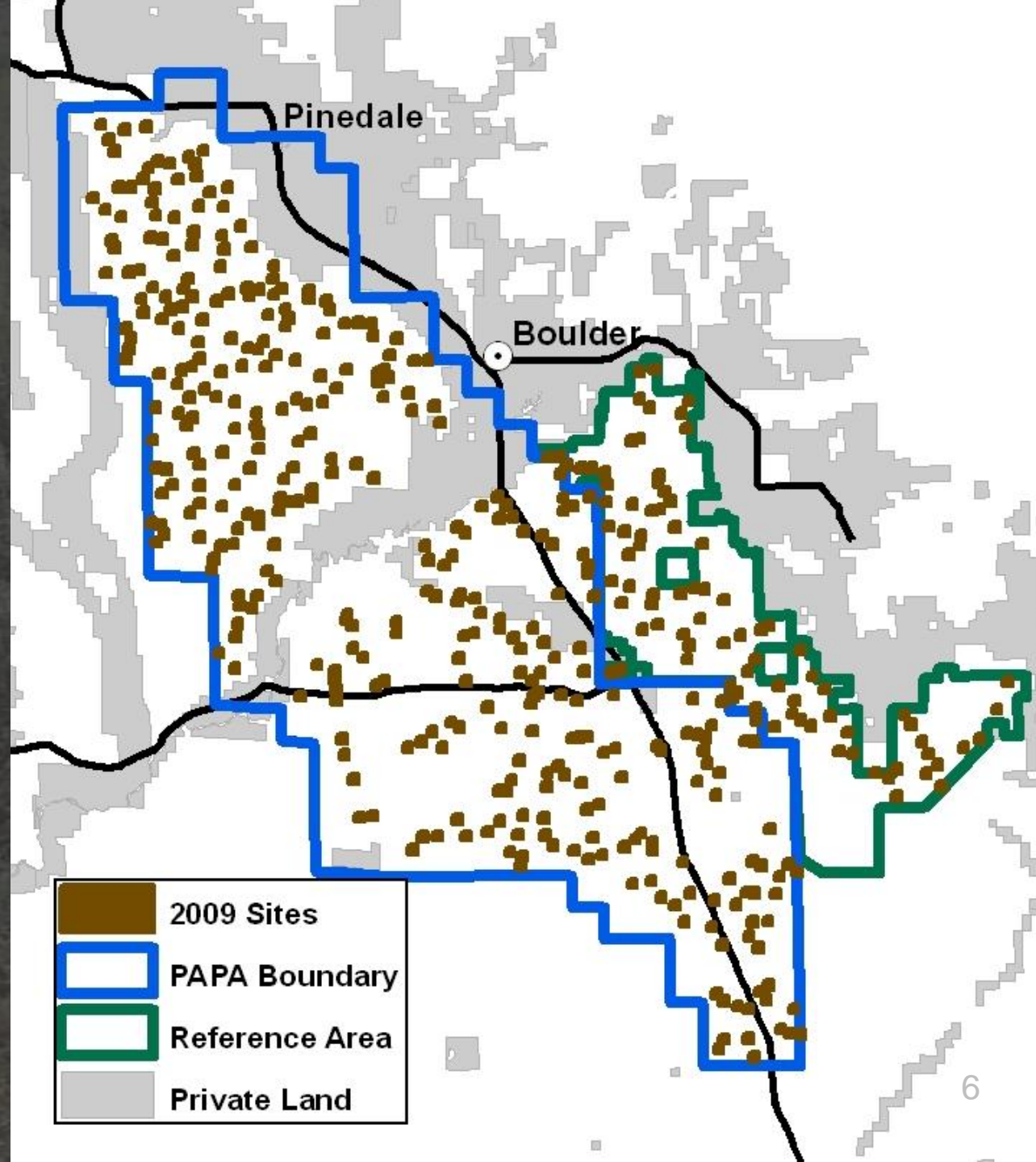
Methods Sampling Design

- 696 sites

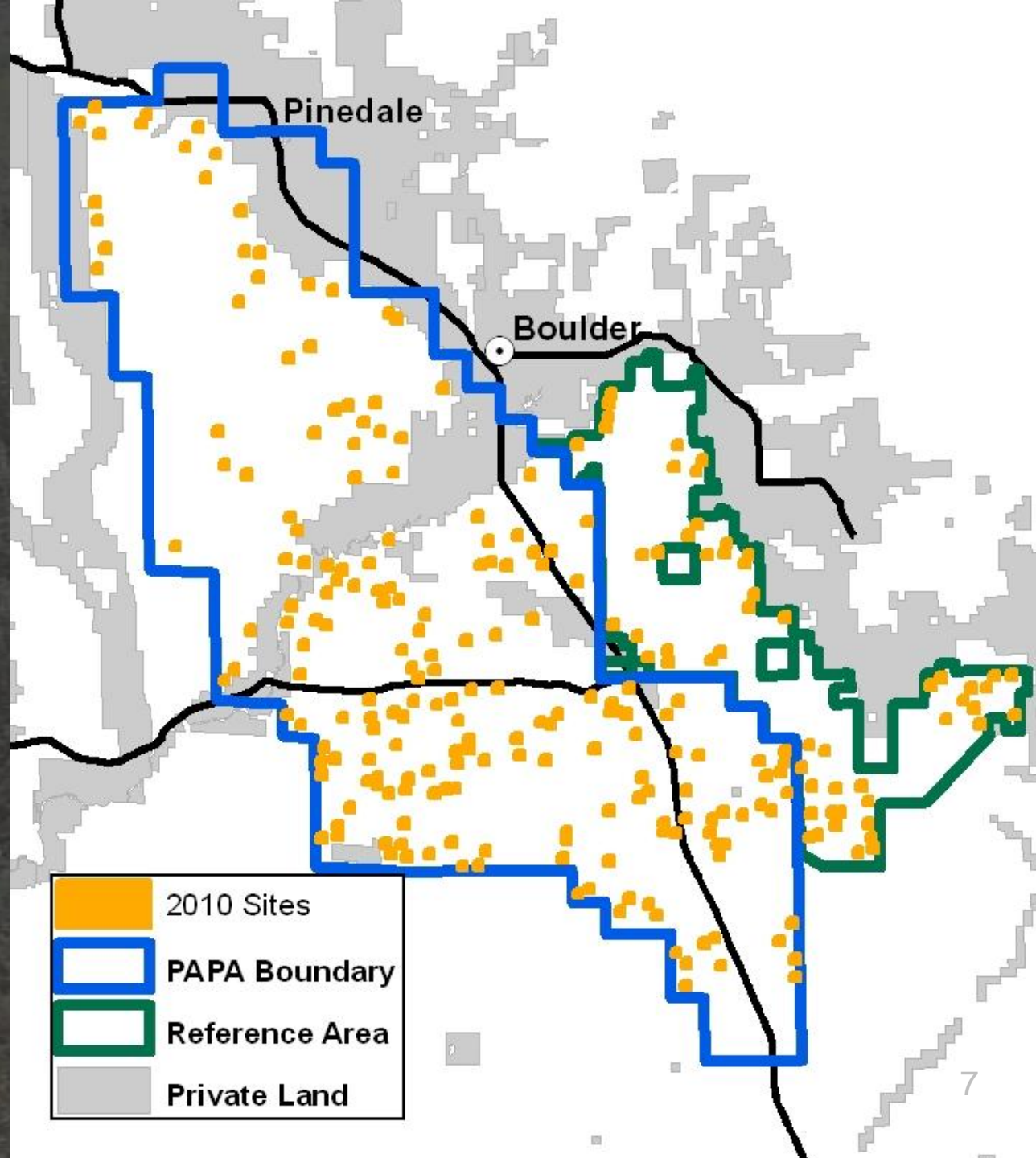- 582 in PAPA
- 114 in Boulder Reference Area

2009 Sites			PAPA Boundary	
2010 Sites			Reference Area	
2011 Sites			Private Land	
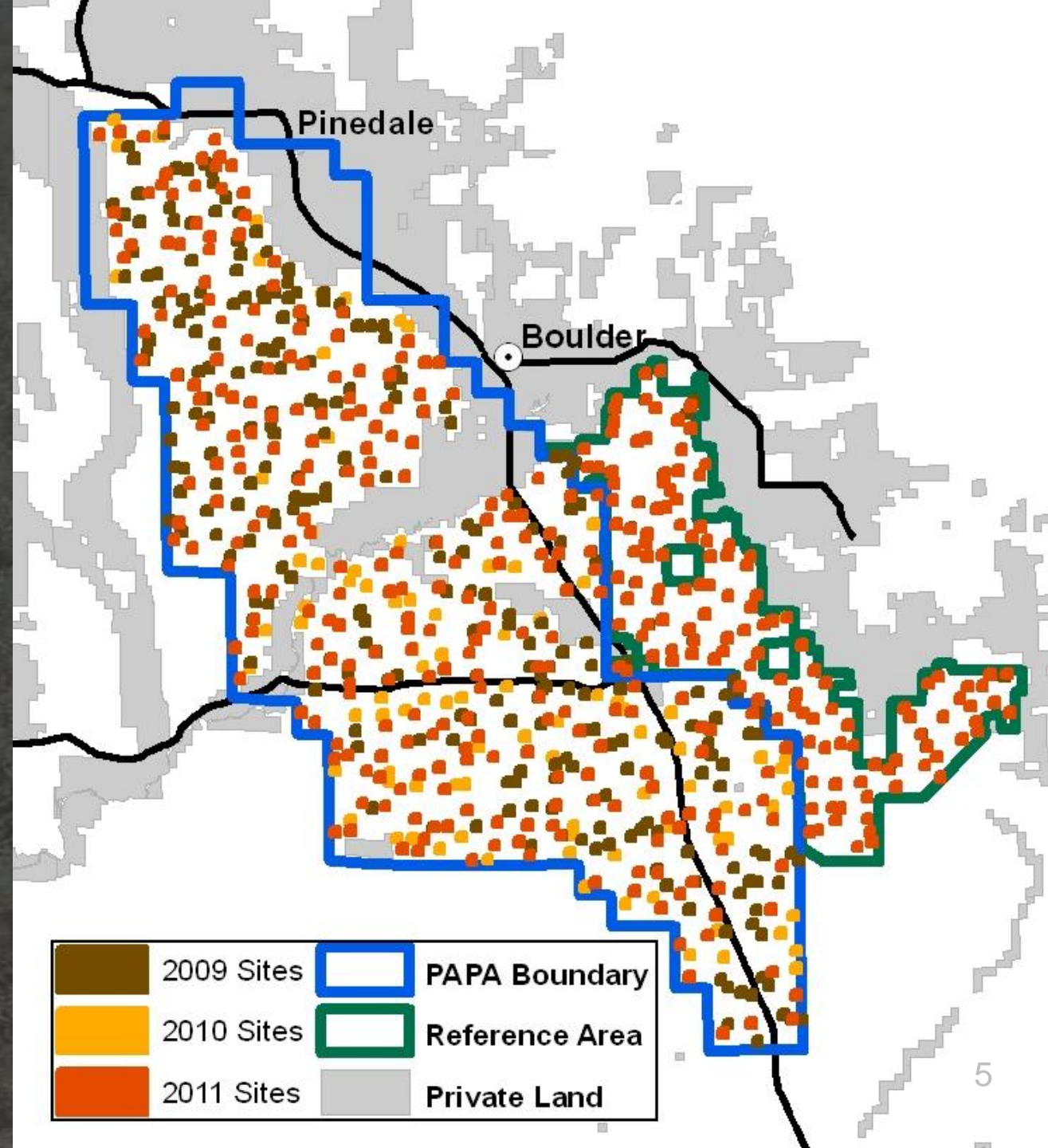
Methods 2009

WYNDD surveyed 444 sites

(1 visit each site)

Legend:
- 2009 Sites
- PAPA Boundary
- Reference Area
- Private Land

Methods 2010

HWA surveyed remaining 252 sites

(2 visits each site)

Pinedale

Boulder

	2010 Sites
	PAPA Boundary
	Reference Area
	Private Land

Methods 2011

HWA surveyed 390 sites

(2 visits each site)

Legend:
- 2011 Sites
- PAPA Boundary
- Reference Area
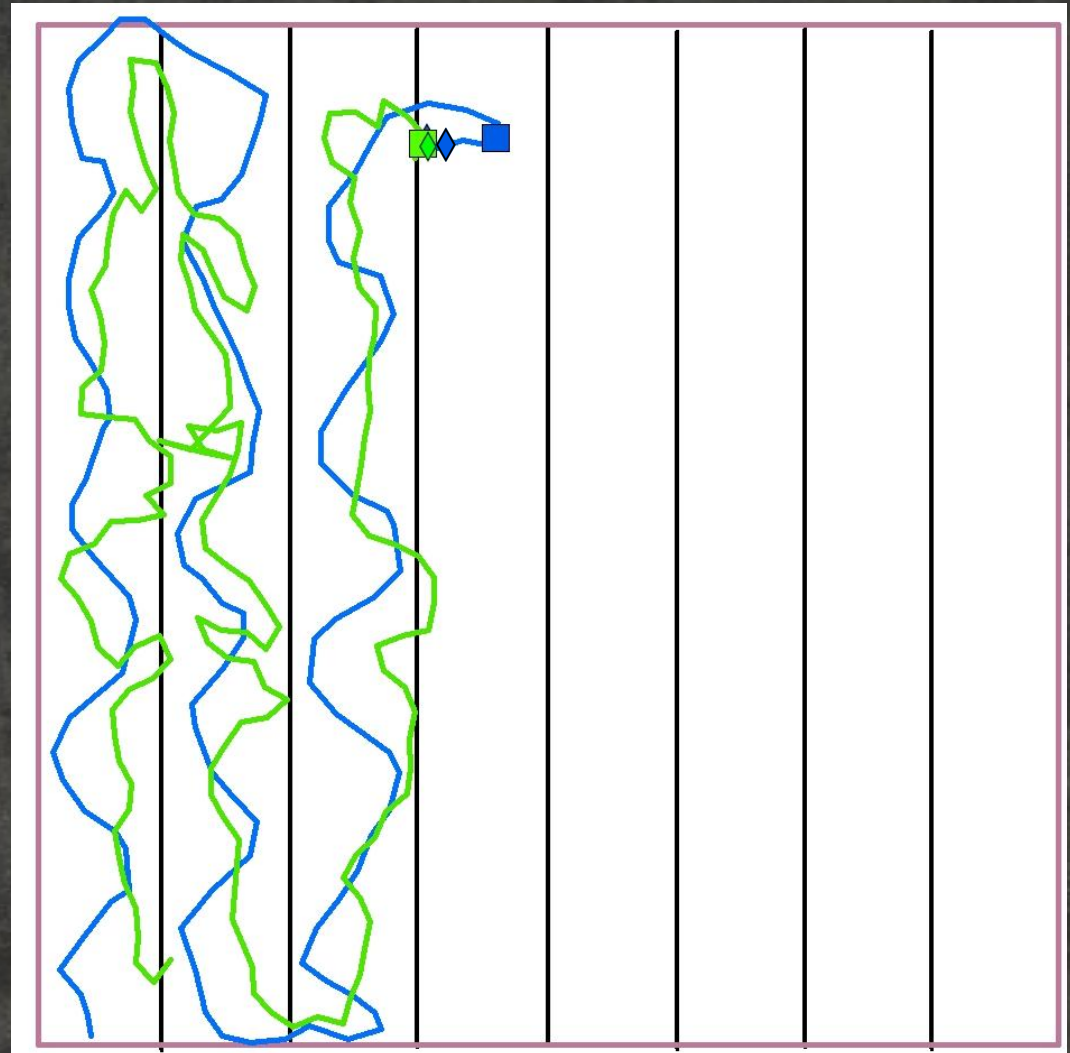- Private Land

Pinedale

Boulder
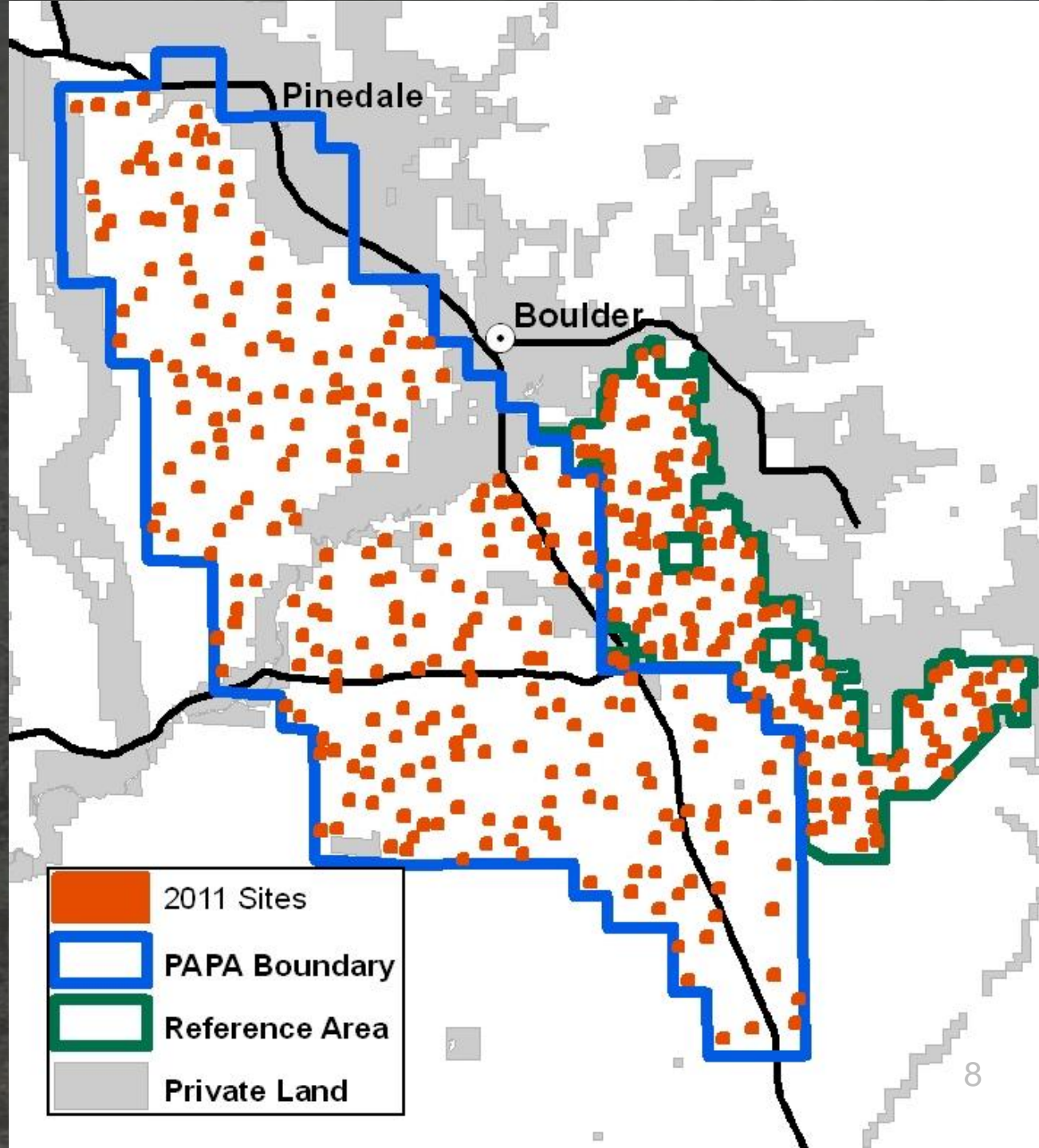
Methods

- Each site 400 m
  x 400 m
- 8 Belt transects, 50 m wide
- Survey Visit 1 & 2:
  - Record presence/absence

Legend

- ◆ **Round 1 Survey Detections**
- ■ **Round 1 Presence Absence**
- — **Round 1 Survey Route**
- ◆ **Round 2 Survey Detections**
- ■ **Round 2 Presence Absence**
- — **Round 2 Survey Route**

Identification of pygmy rabbit presence

Identification of pygmy rabbit presence

- Use fresh sign (positively < 1 year)
- Don't use old sign (possibly > 1 year)

Methods

- Analysis: MARK, Robust Design Occupancy (Mackenzie et al. 2003)
  - Does not assume independence between years
  - Explicitly accounts for local extinction & colonization rates, and detection
  - Estimates occupancy & change in occupancy

- Evaluated 9 *a priori* models with AICc (Burnham & Anderson 2002)

- Separate occupancy and detection estimates for PAPA & Reference

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Results

Model[1]	AIC_c	ΔAIC_c	AIC_c wt	K	Deviance
Ψ(group) ε(group) γ(.) p(group+survey)	1149.57	0.00	0.530	13	1122.90
Ψ(group) ε(group) γ(group) p(group+survey)	1151.02	1.45	0.250	14	1122.24
Ψ(group) ε(.) γ(.) p(group+survey)	1152.13	2.56	0.150	12	1127.55
Ψ(group) ε(.) γ(group) p(group+survey)	1154.14	4.57	0.053	13	1127.00
Ψ(group) ε(group) γ(.) p(.,.)	1176.41	25.40	0.000	6	1164.26
Ψ(group) ε(group) γ(group) p(group,.)	1179.20	28.12	0.000	10	1158.80
Ψ(group) ε(.) γ(.) p(.,.)	1179.74	28.73	0.000	5	1169.64
Ψ(group) ε(.) γ(.) p(year,.)	1180.49	29.48	0.000	6	1168.34
Ψ(group) ε(.) γ(group) p(.,.)	1181.72	32.15	0.000	6	1169.57

[1] Standard notation: Ψ = probability of occupancy, ε = probability of extinction, γ = probability of recolonization, p = probability of detection

Results 2010

- OCCUPANCY:
  - 79% in PAPA (95% CI = 73-85%)
  - 82% in Reference Area (95% CI = 68-91%)

- DETECTION:
  - 75% during survey visit 1 (95% CI = 68%-81%)
  - 95% during survey visit 2 (95% CI = 89-98%)

Results combining 2010 and 2011

- OCCUPANCY:
  - 78% in PAPA (95% CI = 69-85%)
  - 84% in Reference Area (95% CI = 73-91%)

- DETECTION 2010:
  - 75% during survey visit 1 (95% CI = 68-81%)
  - 95% during survey visit 2 (95% CI = 89-98%)

- DETECTION 2011:
  - 88% during survey visit 1 (95% CI = 83-92%)
  - 87% during survey visit 2 (95% CI = 82-91%)

Results (continued)

- Re-colonization (γ)
  - 20% in PAPA (95% CI 9%-40%)
  - 17% in Reference (95% CI 4%-46%)

- Extinction (ε)
  - 43% in PAPA (95% CI 35%-52%)
  - 32% in Reference (95% CI 22%-44%)

Difference in Occupancy

- Between PAPA and reference area:
  - Estimate= 0.075   SE 0.056   CI -0.035 to 0.186

- CI's overlap 1, meaning there is not a significant difference.

- However, this is comparing only two years of data. We have increased the sample size from 2010 and would like to examine another year's data before making conclusions.

Considerations

- Consistent observer skill/training

- Consistent search effort

- Continue using MARK, Robust Design Occupancy (Mackenzie et al. 2003)

- Incorporate covariates

Conclusions

- Occupancy Analysis accounts for detection
  - Yields unbiased occupancy estimates.

- Occupancy = 78% in PAPA & 84% in Reference

- Maintain consistent survey dates among years & between study areas.

- No significant difference between groups 2010-2011
  - Occupancy
  - Extinction
  - Re-colonization

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